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EXAMINER	
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ART UNIT	PAPER NUMBER
2133	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/010,199	Applicant(s) BUTLER ET AL.
	Examiner Dipakkumar Gandhi	Art Unit 2133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-32 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-32 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 04 December 2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 3/18/02, 11/24/03.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

- On page 6, paragraph 1027, "data sink 176" is mentioned. But in figure 1, "data sink 176" reference sign is missing in an empty block next to block 174.
- On page 4, paragraph 1019, "receiver unit 150" is mentioned. But in figure 1, "receiver unit 150" reference sign is missing.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement-drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claim 20 is objected to because of the following informalities: On page 23, line 1 of claim 20; "A digital signal processor comprising comprising" is incorrect. It should be --A digital signal processor comprising--. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

4. Claims 9, 10, 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- As per claim 9, number of erased rows is equal to (D-2) or (D-1). What is definition of D?

- As per claim 10, number of erased rows is less than or equal to (D-3). What is definition of D?
- As per claim 12, number of erased rows exceeds (D-1). What is definition of D?

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1, 4, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) in view of Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399).

As per Claim 1, Weng teaches a method of performing block decoding on a received block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng), comprising: identifying a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng); determining a location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng); marking a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng).

However Weng does not explicitly teach the specific use of performing block decoding for the received block with the marked erased row.

Katayama et al. in an analogous art teach block erasure decoding algorithm (page 394, Katayama et al.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Katayama et al. by including an additional step of performing block decoding for the received block with the marked erased row.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that performing block decoding for the received block with the marked erased row would provide the opportunity for erasure correction block decoding for a block code and receive error free data.

- As per claim 4, Weng and Katayama et al. teach the additional limitations.

Weng teaches the method, wherein the location of the undetected symbol error in the codeword is determined by performing error location on the codeword based on a particular block-decoding scheme (page 10, lines 40-53, Weng).

- As per claim 13, Weng and Katayama et al. teach the additional limitations.

Katayama et al. teach the method, wherein the (N, K) linear block code is a Reed-Solomon code (abstract, page 390, Katayama et al.).

8. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) and Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399) as applied to claim 1 above, and further in view of Nygren et al. (US 2002/0106190 A1).

As per claim 2, Weng and Katayama et al. substantially teach the claimed invention described in claim 1 (as rejected above).

However Weng and Katayama et al. do not explicitly teach the specific use of deriving an estimate of an un-erased systematic row of the received block; comparing the un-erased systematic row against its estimate; and identifying a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword is identified as corresponding to the column containing the unmatched symbol.

Nygren et al. in an analogous art teach similar to the comparison of rows 152, processor 100 sequentially

compares each column 154 of video pixels 150 associated with video data 106b with a corresponding column 154 of video pixels 150 associated with video data 106a until identifying a column 154 of video pixels 150 in which video data 106b is different from video data 106a, as indicated using an asterisk (figure 3A, 3B, page 5, paragraph 53, Nygren et al.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Nygren et al. by including an additional step of deriving an estimate of an un-erased systematic row of the received block; comparing the un-erased systematic row against its estimate; and identifying a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword is identified as corresponding to the column containing the unmatched symbol.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that it would provide the opportunity to determine the location of the codeword with the error.

9. Claims 3, 14, 16, 17, 28, 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2), Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399) and Nygren et al. (US 2002/0106190 A1) as applied to claim 2 above, and further in view of Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16).

As per claim 3, Weng, Katayama et al. and Nygren et al. substantially teach the claimed invention described in claim 2 (as rejected above).

However Weng, Katayama et al. and Nygren et al. do not explicitly teach the specific use of the method, wherein the estimate of the un-erased systematic row is derived by marking the un-erased systematic row as an erased row; forming a reduced received block comprised of K un-erased rows of the received block; and multiplying an inverse generator matrix for the K un-erased rows with the reduced received block.

Rizzo in an analogous art teaches that let $x = x_0 \ldots x_{k-1}$ be the source data, G an n x k matrix, then an (n, k) linear erasure code can by represented by y = Gx where G is such that any submatrix G' made of k rows from G is invertible. If the encoded data include a verbatim copy of the source data items, the code is called a systematic code. This corresponds to including the identity matrix I_k in G. The advantage of a systematic code is that it simplifies the reconstruction of the source data in case one expects very few losses.

Assuming that y', made of k components of y, is available at the receiver, source data can be reconstructed by using the k equations corresponding to the known components of y. If we call G' the k x k matrix representing these equations (see figure 1), reconstructing the source data is possible by solving the linear system $y' = G' x \rightarrow x = G'^{-1} y'$ (figure 1, page 3, Rizzo).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Rizzo by including an additional step of using the method, wherein the estimate of the un-erased systematic row is derived by marking the un-erased systematic row as an erased row; forming a reduced received block comprised of K un-erased rows of the received block; and multiplying an inverse generator matrix for the K un-erased rows with the reduced received block.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that it would provide the opportunity to determine the source data that was transmitted.

- As per claim 14, Weng, Katayama et al. and Nygren et al. and Rizzo teach the additional limitations.

Weng teaches a method of performing block decoding on a received block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng), comprising: determining a location of a symbol error in the codeword based on a particular block decoding scheme (page 10, lines 40-53, Weng); marking a row of the received block containing the symbol error as an erased row (page 3, lines 43-44, Weng).

Rizzo teaches marking each row of the received block as either an erased or an un-erased row until at least (K+1) un-erased rows are found (figure 1, page 3, Rizzo).

Nygren et al. teach deriving an estimate of an un-erased systematic row of the received block; comparing the un-erased systematic row against its estimate; identifying an unmatched symbol between the un-erased systematic row and its estimate; identifying a codeword corresponding to a column of the received block containing the unmatched symbol (figure 3A, 3B, page 5, paragraph 53, Nygren et al.).

Katayama et al. teach performing block decoding for the received block with the marked erased row (page 394, Katayama et al.).

- As per claim 16, Weng, Katayama et al. and Nygren et al. and Rizzo teach the additional limitations.

Rizzo teaches a computer program product and code (page 14, Rizzo).

Nygren et al. teach deriving an estimate of an un-erased systematic row of the received block; comparing the un-erased systematic row against its estimate; and identifying a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword with the undetected symbol error is identified as corresponding to the column containing the unmatched symbol (figure 3A, 3B, page 5, paragraph 53, Nygren et al.).

- As per claim 17, Weng, Katayama et al. and Nygren et al. and Rizzo teach the additional limitations.

Rizzo teaches a computer program product and code (page 14, Rizzo).

Rizzo teaches deriving the estimate of the un-erased systematic row includes: code for marking the un-erased systematic row as an erased row; code for forming a reduced received block comprised of K un-erased rows of the received block; and code for multiplying an inverse generator matrix for the K un-erased rows with the reduced received block (figure 1, page 3, Rizzo).

- As per claim 28, Weng, Katayama et al. and Nygren et al. and Rizzo teach the additional limitations.

Katayama et al. teach a decoding apparatus (page 390, Katayama et al.)

Nygren et al. teach means for deriving an estimate of an un-erased systematic row of the received block; means for comparing the un-erased systematic row against its estimate; and means for identifying a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword with the undetected symbol error is identified as corresponding to the column containing the unmatched symbol (figure 3A, 3B, page 5, paragraph 53, Nygren et al.).

- As per claim 29, Weng, Katayama et al. and Nygren et al. and Rizzo teach the additional limitations.

Katayama et al. teach a decoding apparatus (page 390, Katayama et al.).

Rizzo teaches the means for performing block decoding includes: means for marking the un-erased systematic row as an erased row; means for forming a reduced received block comprised of K un-erased rows of the received block; and means for multiplying an inverse generator matrix for the K un-erased rows with the reduced received block (figure 1, page 3, Rizzo).

10. Claims 5-7, 15, 18, 24, 25, 26, 27, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) and Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399) as applied to claim 1 above, and further in view of Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16).

As per claim 5, Weng and Katayama et al. substantially teach the claimed invention described in claim 1 (as rejected above).

However Weng and Katayama et al. do not explicitly teach the specific use of the method, wherein the performing block decoding includes forming a reduced received block comprised of K un-erased rows of the received block; forming a reduced generator matrix comprised of K rows of a generator matrix corresponding to the K un-erased rows; inverting the reduced generator matrix; and multiplying the inverted generator matrix with the reduced received block.

Rizzo in an analogous art teaches that let $x = x_0 \ldots x_{k-1}$ be the source data, G an n x k matrix, then an (n, k) linear erasure code can by represented by y = Gx where G is such that any submatrix G' made of k rows

from G is invertible. If the encoded data include a verbatim copy of the source data items, the code is called a systematic code. This corresponds to including the identity matrix I_k in G. The advantage of a systematic code is that it simplifies the reconstruction of the source data in case one expects very few losses.

Assuming that y', made of k components of y, is available at the receiver, source data can be reconstructed by using the k equations corresponding to the known components of y. If we call G' the k x k matrix representing these equations (see figure 1), reconstructing the source data is possible by solving the linear system $y' = G' x \rightarrow x = G'^{-1} y'$ (figure 1, page 3, Rizzo).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Rizzo by including an additional step of using the method, wherein the performing block decoding includes forming a reduced received block comprised of K un-erased rows of the received block; forming a reduced generator matrix comprised of K rows of a generator matrix corresponding to the K un-erased rows; inverting the reduced generator matrix; and multiplying the inverted generator matrix with the reduced received block.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that it would provide the opportunity to determine the source data that was transmitted.

- As per claim 6, Weng, Katayama et al. and Rizzo teach the additional limitations.

Rizzo teaches the method, further comprising: marking each row of the received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found (figure 1, page 3, Rizzo).

- As per claim 7, Weng, Katayama et al. and Rizzo teach the additional limitations.

Weng teaches the method, wherein each row is marked as an erased row or an un-erased row based on a result of a cyclic redundancy check (CRC) test (page 3, lines 43-44, Weng).

- As per claim 15, Weng, Katayama et al. and Rizzo teach the additional limitations.

Rizzo teaches a computer program product, code and a computer-usable medium for storing the codes (page 14, Rizzo).

Weng teaches performing block decoding on a received block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng), comprising: identifying a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng); determining a location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng); marking a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng);
Katayama et al. teach code for performing block decoding for the received block with the marked erased row (page 394, Katayama et al.).

- As per claim 18, Weng, Katayama et al. and Rizzo teach the additional limitations.

Rizzo teaches a computer program product and code (page 14, Rizzo).
Rizzo teaches performing block decoding includes: code for forming a reduced received block comprised of K un-erased rows of the received block; code for forming a reduced generator matrix comprised of K rows of a generator matrix corresponding to the K un-erased rows; code for inverting the reduced generator matrix; and code for multiplying the inverted generator matrix with the reduced received block (figure 1, page 3, Rizzo).

- As per claim 24, Weng, Katayama et al. and Rizzo teach the additional limitations.

Katayama et al. teach a decoder (page 390, Katayama et al.) and perform block decoding for the received block with the marked erased row (page 394, Katayama et al.). Weng teaches a first decoder operative to receive a block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng) and a second decoder operative to identify a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng), determine the location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng), mark a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng).
Rizzo teaches to mark each row of the received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found (figure 1, page 3, Rizzo).

- As per claim 25, Weng, Katayama et al. and Rizzo teach the additional limitations.

Weng teaches that the first decoder is operative to mark each row as an erased row or an un-erased row based on a result of a cyclic redundancy check (CRC) test (page 3, lines 43-44, Weng).

- As per claim 26, Weng, Katayama et al. and Rizzo teach the additional limitations.

Katayama et al. teach the decoder, wherein the (N, K) linear block code is a Reed-Solomon code (abstract, page 390, Katayama et al.).

- As per claim 27, Weng, Katayama et al. and Rizzo teach the additional limitations.

Katayama et al. teach a decoding apparatus (page 390, Katayama et al.) and means for performing block decoding for the received block with the marked erased row (page 394, Katayama et al.).

Weng teaches each row of a received block, previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng), means for identifying a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng); means for determining a location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng) and means for marking a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng).

Rizzo means for marking each row of a received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found (figure 1, page 3, Rizzo).

- As per claim 30, Weng, Katayama et al. and Rizzo teach the additional limitations.

Katayama et al. teach a decoding apparatus (page 390, Katayama et al.).

Rizzo teaches the means for performing block decoding includes: means for forming a reduced received block comprised of K un-erased rows of the received block; means for forming a reduced generator matrix comprised of K rows of a generator matrix corresponding to the K un-erased rows; means for inverting the reduced generator matrix; and means for multiplying the inverted generator matrix with the reduced received block (figure 1, page 3, Rizzo).

11. Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) and Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399) as applied to claim 1 above, and further in view of Spruyt (US 5,636,253).

As per claim 8, Weng and Katayama et al. substantially teach the claimed invention described in claim 1 (as rejected above).

However Weng and Katayama et al. do not explicitly teach the specific use of the method, further comprising: determining the number of erased rows in the received block.

Spruyt in an analogous art teaches the present invention relates to a method for detecting erasures in a stream of sets of digital signal values received at a receiver side after transmission from a transmission side (col. 1, lines 6-8, Spruyt). Spruyt also teaches that the advantage of being able to detect whether a set is erased or not becomes apparent when the stream of digital signal values is encoded according to an error-correcting code having a so-called minimum distance d. Indeed, in that case, a number of R errors and E erasures in this bit stream may be corrected when 2 X R + E + 1 <= d. Thus, by detecting erasures the error correcting capability of the code is doubled for a given minimum distance d (col. 1, lines 28-35, Spruyt).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Spruyt by including an additional step of using the method, further comprising: determining the number of erased rows in the received block.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that using the method, further comprising: determining the number of erased rows in the received block would provide the opportunity to correct the errors in the data received.

- As per claim 9, Weng, Katayama et al. and Spruyt teach the additional limitations.

Spruyt teaches the method, further comprising: performing erasure-only correction block decoding if the number of erased rows is equal to (D-2) or (D-1), (col. 1, lines 28-35, Spruyt).

- As per claim 10, Weng, Katayama et al. and Spruyt teach the additional limitations.

Spruyt teaches the method, further comprising: performing erasure-and-error correction block decoding if the number of erased rows is less than or equal to (D-3), (col. 1, lines 28-35, Spruyt).

- As per claim 11, Weng, Katayama et al. and Spruyt teach the additional limitations.

Spruyt teaches the method, further comprising: determining the number of erased systematic rows in the received block (col. 1, lines 6-8, col. 1, lines 28-35, Spruyt).

Katayama et al. teach performing erasure-and-error correction block decoding if the number of erased systematic rows is less than or equal to (K-1), (page 394, Katayama).

- As per claim 12 Weng, Katayama et al. and Spruyt teach the additional limitations.

Spruyt teaches the method, further comprising: declaring an error if the number of erased rows exceeds (D-1), (col. 1, lines 28-35, Spruyt).

12. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) in view of Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399) and Campana, Jr. (US 5,446,759).

As per Claim 19, Weng teaches identifying a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng); determining a location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng); marking a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng). However Weng does not explicitly teach the specific use of performing block decoding for the received block with the marked erased row.

Katayama et al. in an analogous art teach block erasure decoding algorithm (page 394, Katayama et al.). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Katayama et al. by including an additional step of performing block decoding for the received block with the marked erased row.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that performing block decoding for the received block with the marked erased row would provide the opportunity for erasure correction block decoding for a block code and receive error free data.

Weng also does not explicitly teach the specific use of a memory communicatively coupled to a digital signal-processing device (DSPD) capable of interpreting digital information.

However Campana, Jr. in an analogous art teaches that the digital signal processor U3' is connected to a 2K random access memory U4 and a 4K EEROM memory U5'. A second data bus DATA BUS 2 is utilized to permit data to be read by the digital signal processor U3' from and to the RAM memory and from the EROM memory which contains the stored program. The digital signal processor U3' controls the selection of reading and writing to RAM memory U4' and reading from EEROM memory U5' by the address control U6' portion of a custom gate array U6B' (col. 82, lines 29-38, Campana, Jr.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Campana, Jr. by including an additional step of using the memory communicatively coupled to a digital signal processing device (DSPD) capable of interpreting digital information.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that using the memory communicatively coupled to a digital signal processing device (DSPD) capable of interpreting digital information would provide the opportunity to temporarily store intermediate calculations and reconstructed received data in the memory as needed by the digital signal processing device.

13. Claims 20, 22, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) in view of Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399), Campana, Jr. (US 5,446,759) and Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16).

As per claim 20, Weng teaches a first unit operative to receive a block of symbols previously coded column-wise with an (N, K) linear block code and row-wise with an error detection code (page 3, lines 11-19, Weng), and a second unit operative to identify a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng), determine the location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng), mark a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng).

However Weng does not explicitly teach the specific use of performing block decoding for the received block with the marked erased row.

Katayama et al. in an analogous art teach block erasure decoding algorithm (page 394, Katayama et al.). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Katayama et al. by including an additional step of performing block decoding for the received block with the marked erased row.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that performing block decoding for the received block with the marked erased row would provide the opportunity for erasure correction block decoding for a block code and receive error free data.

Weng also does not explicitly teach the specific use of marking each row of the received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found.

However Rizzo in an analogous art teaches that gray areas represent missing blocks (or components of y). G' is made of the white rows of G (figure 1, page 3, Rizzo).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Rizzo by including an additional step of marking each row of the received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that marking each row of the received block as either an erased row or an un-erased row until at least (K+1) un-erased rows are found would provide the opportunity to decode the data and remove the rows of the data that are erased.

Weng also does not explicitly teach the specific use of a digital signal processor.

However Campana, Jr. in an analogous art teaches that the digital signal processor U3' is connected to a 2K random access memory U4 and a 4K EEROM memory U5'. A second data bus DATA BUS 2 is utilized to permit data to be read by the digital signal processor U3' from and to the RAM memory and from the EROM memory which contains the stored program. The digital signal processor U3' controls the

selection of reading and writing to RAM memory U4' and reading from EEROM memory U5' by the address control U6' portion of a custom gate array U6B' (col. 82, lines 29-38, Campana, Jr.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Campana, Jr. by including an additional step of using a digital signal processor.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that using the digital signal processor would provide the opportunity to decode the received data faster and accurately.

- As per claim 22, Weng, Katayama et al., Campana, Jr. and Rizzo teach the additional limitations. Rizzo teaches that the second unit is further operative to mark the un-erased systematic row as an erased row, form a reduced received block comprised of K un-erased rows of the received block, and multiply an inverse generator matrix for the K un-erased rows with the reduced received block (figure 1, page 3, Rizzo).

- As per claim 23, Weng, Katayama et al., Campana, Jr. and Rizzo teach the additional limitations. Rizzo teaches that the second unit is further operative to form a reduced received block comprised of K un-erased rows of the received block, form a reduced generator matrix comprised of K rows of a generator matrix corresponding to the K un-erased rows, invert the reduced generator matrix, and multiply the inverted generator matrix with the reduced received block (figure 1, page 3, Rizzo).

14. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2), Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399), Campana, Jr. (US 5,446,759) and Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16) as applied to claim 20 above, and further in view of Nygren et al. (US 2002/0106190 A1).

As per claim 21, Weng, Katayama et al., Campana, Jr. and Rizzo substantially teach the claimed invention described in claim 20 (as rejected above).

However Weng, Katayama et al., Campana, Jr. and Rizzo do not explicitly teach the specific use of the second unit that is further operative to derive an estimate of an un-erased systematic row of the received block, compare the un-erased systematic row against its estimate, and identify a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword with the undetected symbol error is identified as corresponding to the column containing the unmatched symbol.

Nygren et al. in an analogous art teach similar to the comparison of rows 152, processor 100 sequentially compares each column 154 of video pixels 150 associated with video data 106b with a corresponding column 154 of video pixels 150 associated with video data 106a until identifying a column 154 of video pixels 150 in which video data 106b is different from video data 106a, as indicated using an asterisk (figure 3A, 3B, page 5, paragraph 53, Nygren et al.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Nygren et al. by including an additional step of using the second unit that is further operative to derive an estimate of an un-erased systematic row of the received block, compare the un-erased systematic row against its estimate, and identify a location of an unmatched symbol between the un-erased systematic row and its estimate, and wherein the codeword with the undetected symbol error is identified as corresponding to the column containing the unmatched symbol.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that it would provide the opportunity to determine the location of the codeword with the error.

15. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2) in view of Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399), Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16) and Spruyt (US 5,636,253).

As per claim 31, Weng teaches a second decoder operative to identify a codeword corresponding to a column of the received block where an undetected symbol error is located (page 3, line 48, page 6, lines 54-55, Weng), determine the location of the undetected symbol error in the codeword (page 10, lines 40-53, Weng), mark a row of the received block containing the undetected symbol error as an erased row (page 3, lines 43-44, Weng).

However Weng does not explicitly teach the specific use of performing block decoding for the received block with the marked erased row.

Katayama et al. in an analogous art teach block erasure decoding algorithm (page 394, Katayama et al.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Katayama et al. by including an additional step of performing block decoding for the received block with the marked erased row.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that performing block decoding for the received block with the marked erased row would provide the opportunity for erasure correction block decoding for a block code and receive error free data.

Weng also does not explicitly teach the specific use of a receiver unit in a wireless communication system, comprising: a receiver operative to process a received signal to provide data samples.

However Rizzo in an analogous art teaches that FEC is heavily used in data link protocols for wireless networks. Mobile devices usually have a limited power budget. Consider the case of a mobile device browsing the Web over a wireless connection. After the initial request to the server, data can be sent to the mobile unit with a highly redundant encoding, and using large values of k (page 10-11, Rizzo).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Rizzo by including an additional step of using a receiver unit in a wireless communication system, comprising: a receiver operative to process a received signal to provide data samples.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that using a receiver unit in a

wireless communication system, comprising: a receiver operative to process a received signal to provide data samples would provide the opportunity to acquire and process the data sent from the transmitter. Weng also does not explicitly teach the specific use of a demodulator operative to process the data samples to provide a received block of symbols and a first decoder operative to mark each row of the received block as either an erased row or an un-erased row.

However Spruyt in an analogous art teaches that the present invention relates to a method for detecting erasures in a stream of sets of digital signal values received at a receiver side after transmission from a transmission side (col. 1, lines 5-7, Spruyt).

Spruyt also teaches that the receipt branch includes connected to the INF the cascaded connection of an analog to digital converter ADC, a demodulator DEM. A digital signal is then demodulated in the demodulator (figure 2, col. 5, lines 21-23, col. 6, lines 9-10, Spruyt).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Spruyt by including an additional step of using a demodulator operative to process the data samples to provide a received block of symbols and a first decoder operative to mark each row of the received block as either an erased row or an un-erased row.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that it would provide the opportunity to extract the signal from a carrier with minimum distortion and to remove the rows of the data that are erased.

16. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weng (EP 0407101 A2), Katayama et al. ("One-Shot Reed-Solomon Decoding for High-Performance Dependable Systems", 2000 IEEE International Networks, NY, USA, June 25, 2000, pages 390-399), Rizzo, Luigi ("On the feasibility of software FEC", Dip. di Ingegneria dell'Informazione, Universita di Pisa via Diotisalvi 2 - 56126 Pisa (Italy), January 31, 1997, pages 1-16) and Spruyt (US 5,636,253) as applied to claim 31 above, and further in view of Hartman, Jr. (US 2002/0075830 A1).

As per claim 32, Weng, Katayama et al., Rizzo and Spruyt substantially teach the claimed invention described in claim 31 (as rejected above). Spruyt also teaches the receiver unit further comprising: a third decoder operative to receive and decode demodulated data from the demodulator (figure 2, Spruyt) However Weng, Katayama et al., Rizzo and Spruyt do not explicitly teach the specific use of a particular convolutional decoding scheme to provide the received block of symbols.

Hartman, Jr. in an analogous art teach that the decoder block converts the symbols to bit representations, then de-interleaves the received bits and performs convolutional decoding (page 6, paragraph 72, Hartman, Jr.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Weng's patent with the teachings of Hartman, Jr. by including an additional step of using a particular convolutional decoding scheme to provide the received block of symbols.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that using a particular convolutional decoding scheme to provide the received block of symbols would provide the opportunity to correct the errors in the data received from the transmitter.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dipakkumar Gandhi whose telephone number is 703-305-7853. The examiner can normally be reached on 8:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (703)305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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